think that we see here a new species arise by the production, through many generations, of an increasing number of individuals (*rufa* forms) among the offspring, that are markedly unlike the parents (*austriaca* forms). We believe that *austriaca* forms give rise to *rufa* forms, but we have no evidence of the reverse process."

AT the conclusion of the second part of his memoir on the development of the molluscan lingual ribbon, or radula, Mr. H. Schnabel, in the *Zeitschrift für wissenschaftliche Zoologie*, vol. lxxiv. part iv., points out an important distinction in this between cephalopods and gastropods. In contrast to the cephalopods, the development of the radula in the gastropods commences, not with the appearance of the single unpaired median row of teeth, but with a number of paired lateral rows. The other contents of the issue include an article on gastrulation in Cucullanus, by E. Martini; an essay on the morphology of the male genital appendages of the Lepidoptera, by E. Zander; and an account of the structure of the bristles in certain chætopods and brachiopods, by A. Schepotieff.

THE alleged occurrence of "aptosochromatism," that is, colour-change in feathers without moulting, in birds, has by no means met with universal acceptation, one at least of the late Mr. F. J. Birtwell's three papers on this subject having been adversely criticised. Shortly before his death Mr. Birtwell entered on a fresh series of observations in the hope of establishing his theory on a basis which would be beyond question. These observations, which were made on two species of buzzard, are now published in the *Bulletin* of the Hadley Laboratory of the University of New Mexico (vol. iii. No. 7).

AN Irish specimen of Dopplerite has been described by Mr. Richard J. Moss (*Sci. Proc.* Royal Dublin Soc., vol. x. No. 6). It was found in peat in Sluggan bog, at Drumsue, near Cookstown Junction, in County Antrim. In its original moist condition it appeared like a stiff jelly of a velvety-black colour, but when dry it became very like jet, breaking with a conchoidal fracture, and exhibiting a vitreous lustre. Dopplerite was originally found in peat in Styria, and has not previously been recorded from Britain. It appears to have been formed from peat by a process of oxidation.

A HANDBOOK to Southport, which should prove of much service to those attending the meeting who are not well acquainted with the town, has been written for the members of the British Association. Southport is considered from a historical and descriptive point of view, and as a health resort. Other chapters are devoted to meteorology, geology, botany, zoology, Martin Mere, archæology, and the life and works of the Rev. Jeremiah Horrocks (spelt in the volume Horrox). The volume is published by Messrs. Fortune and Chant, of Southport, and appears to have been carefully prepared.

THE current issue of the *Illustrated Scientific News* is a double one, and brings to a close our contemporary's first volume. The number contains many interesting articles, among which there are no fewer than three respecting the British Association; one is illustrated by portraits of the president and five of the presidents of sections for this year. Other contributions deal with "Charlottenburg," the "Solar Physics Observatory at Meudon," "Progress with Airships," &c.

THE additions to the Zoological Society's Gardens during the past week include two Black Rats (*Mus rattus*), British, presented by Mr. J. E. Millais; a Ducorps's Cockatoo (*Cacatua ducorpsi*) from the Solomon Islands, presented by Mrs. J. Aarons; a Neumann's Baboon (*Papio neumanni*), a Doguera Baboon (*Papio doguera*) from Abyssinia, a Bell's Cinixys (*Cinixys belliana*) from Tropical Africa, an Adanson's Sternothere (*Sternothoerus adansoni*) from North-east Africa, deposited; three Fat-tailed Desert Mice (*Pachuromys dupresi*), born in the Gardens.

OUR ASTRONOMICAL COLUMN.

SEARCH-EPHEMERIS FOR FAYE'S COMET.—In No. 3896 of the *Astronomische Nachrichten*, Herr E. Strömgren gives a continuation of the search-ephemeris for Faye's comet which appeared in No. 3876 of the same periodical, and was reproduced in these columns. The following is an extract from the later portion:—

Ephemeris 12*h.* (*M.T. Berlin*).

1903	α h. m. s.	δ ° ′	log r	log Δ
Sept. 12	8 5 14	+12 13·4	0·2842	0.3864
,, 16	8 13 26	+11 34·8	—	—
,, 20	8 21 24	+10 55·5	0·2930	0·3821
,, 24	8 29 6	+10 15·5	—	—
,, 28	8 36 31	+ 9 35·1	0·3020	0·3771
Oct. 6	8 50 32	+ 8 13·4	0·3110	0·3712
,, 14	9 3 28	+ 6 51·6	0·3201	0·3645
,, 22	9 15 15	+ 5 30·7	0·3293	0·3569
,, 30	9 25 48	+ 4 11·8	0·3384	0·3484

THE CANALS ON MARS.—In the fifth report of "The Section for the Observation of Mars" (British Astronomical Association *Memoirs*, vol. xi.), several charts of the planet's surface are reproduced, in one of which, Plate viii., the director of the section, M. E. M. Antoniadi, has omitted the reticulated canal systems so familiar to aërographers on the charts published during the last twenty-five years. These have been omitted because recent research has thrown grave doubts on their objective reality.

In the recent experiments carried out by Messrs. Maunder and Lane it was demonstrated that the regular "canaliform" markings may be consistently seen by numerous unbiased individuals on a surface which is free from any such markings, but which has drawn on it features similar to the other markings on Mars. It was also pointed out that, in general, the so-called canals on aërographical maps are drawn either from one projecting feature to another or where half-tone boundaries are seen on the planet, just where one would expect them to be drawn if they were really due to physiological suggestion.

Many so-called "canals" are retained on M. Antoniadi's chart, but these are not of the rigidly geometrical shape shown on the charts published during recent years, and are, probably, objective features of the Martian landscape (the *Observatory*, No. 335).

RADIATION PRESSURE AND COMETARY THEORY.—In No. 5, vol. xvii., of the *Astrophysical Journal*, Messrs. E. F. Nicholls and G. F. Hull describe and illustrate some laboratory experiments they have made at Dartmouth College, Hanover, U.S.A., in order to demonstrate the effect of the solar radiation pressure in the formation of comets' tails.

A glass tube shaped like an hour-glass was partially filled with sand and dried lycopodium powder, and then highly evacuated. On causing the sand and powder to fall from the upper to the lower part of the tube, and directing an intense beam of light against the stream, it was seen that, whilst the sand fell vertically, the powder was diverted in the direction of the beam against the side of the tube opposite to the light source. Unfortunately the light pressure, on particles of the size and density used, had been previously overestimated, and a subsequent calculation showed that the observed deviation may not have been wholly due to the light-pressure, although some of it was.

Another suggestion as to the cause of repulsion in cometary phenomena is that the particles heated from one side evolve gases, and are, therefore, driven in the opposite

direction in a similar manner to the ordinary rocket, and in the experiments performed by Messrs. Nicholls and Hull this "reaction" pressure would be about ten times as great as the "radiation" pressure. This research has experimentally illustrated the repulsion, and has shown that a part of it at least is probably due to the "radiation" pressure; it now remains to determine more definitely the relative effect of each of the possible causes.

A CATALOGUE OF 1520 BRIGHT STARS.—As the "Revised Harvard Photometry," which will contain details of about nine thousand stars of magnitude 6·5 and brighter, is not yet ready, the Harvard College Observatory has published a smaller catalogue, which only contains 1520 stars, and does not give the detailed information which will be contained in the larger volume.

The catalogue gives, in tabular form, the H.P. number, the constellation name, the R.A. and declination, the magnitude and the type of spectrum for each star, and a comprehensive set of "remarks" describes the peculiarities appertaining to various stars included in the list.

A large edition of the catalogue has been prepared, and anyone interested may obtain a copy on applying to the director.

IRON AND STEEL INSTITUTE.

THE autumn meeting of the Iron and Steel Institute was held in the Town Hall, Barrow-in-Furness, on September 1, 2, and 3, with Mr. Andrew Carnegie, the president, in the chair, and was very largely attended. After an eloquent address of welcome from the Mayor, Mr. Carnegie delivered a short presidential address, in which he traced the progress made in the metallurgy of iron and steel since the Institute's last visit to Barrow twenty-nine years ago. After various business announcements had been made by the secretary, Mr. Bennett H. Brough, the reading and discussion of the thirteen papers on the programme began. The first read was that by Mr. R. A. Hadfield on the alloys of iron and tungsten. This formed a monograph of sixty-eight closely printed pages. It contains historical details regarding the ores of tungsten, the metal and its alloys, and a large amount of physical data. It concludes with a carefully compiled bibliography of the subject, showing that a large amount of attention has been devoted to studies of this interesting metal and its employment in the manufacture of steel. Osmond, by his cooling curves, has brought out several peculiar points in the thermal behaviour of this steel, and Barrett has discovered that tungsten affects the conductivity of iron less than any other added element. Though tungsten-iron alloys will have an important future, there is no doubt that their use is not likely to be on the same large scale as some of the other special steels now produced. In the discussion some interesting details were added by Mr. F. W. Harbord and by Mr. J. E. Stead.

This paper was followed by a series of memoirs dealing with the heat treatment of steel. These were discussed together.

The paper read by Mr. J. E. Stead and Mr. Arthur W. Richards on the restoration of dangerously crystalline steel by heat treatment established facts of far-reaching importance. The microscope shows that heating at high temperatures causes a great development in the size of the crystalline grains, and reheating to about 870° restores the original or a better structure. If all structural steels in their normal rolled or forged condition are good, they can be readily deteriorated in quality by heating to a temperature a little above that to which steel is most commonly heated previous to rolling or forging. Steel made brittle by such heating, and dangerously brittle by heating at considerably higher temperatures, can be completely restored to the best possible condition without forging down to a smaller size or by remelting. Not only are the original good qualities of normally rolled steel, after making brittle, restored by the exceedingly simple treatment of heating to about 900° C. for a very short time, but such steel is made considerably better than it was. That brittle "soft steel" can be restored by reheating is well known, but that carbon steels can be actually made much superior to the original properly forged metal by reheating to 870° and cooling in air is a discovery. It is urged that in every large forge and smith's shop Le Chatelier pyrometers should be introduced, together with suitable furnaces for reheating the forgings.

Mr. J. E. Stead and Mr. Arthur W. Richards next read a remarkable paper on sorbitic steel rails. The term sorbitic is used for a transition condition of the carbide intermediate between the states in which it exists in hardened and annealed steels. The chief point of interest in the authors' work is the simple method employed for producing sorbite in steel. The usual custom has been to reheat and oil-harden, or to quench completely in water and reheat to dull redness. They avoid reheating, and quench the heads of the rails, and allow the residual heat in the rails to do the tempering. The results of the later experiments show clearly enough that by partially quenching the heads and allowing the rails to temper themselves, although the elongation is decreased, the contraction of area remains practically the same. A normal rail of 37 tons tenacity when made sorbitic is increased in strength to 45 tons without diminution of the contraction of area. A normal rail with 36½ tons tenacity is increased to 49 tons with a slight increase in the contraction of area. In other cases the tenacity is increased from 43 to 50 tons with a slight diminution in the contraction of the area. Pieces of the rail cut from the area of maximum sorbite on being tested by repeated reversals of strain showed greater toughness and endurance than the normal material. The wear is very greatly in favour of the sorbitic material, as would naturally be expected, and it is believed that, by treating the rails in the simple manner described, their life will be increased from 25 to 50 per cent. The results obtained should lead metallurgists to aim at replacing pearlite by sorbite in all structural steels that have to be subjected to friction, percussion, or vibration when in use.

A paper on the heat treatment of steel rails high in manganese was contributed by Mr. J. S. Lloyd (South Russia). Steels containing more than 1 per cent. of manganese have not hitherto been fully studied, and a research carried out in Russia by the author shows that, at the ordinary normal heat suitable for rolling ingots, steel containing 0·46 per cent. of carbon and 1·33 per cent. of manganese is made exceedingly brittle if it is not further treated, but is allowed to cool on the mill floor. Slowly cooling in the furnace after heating for eighteen hours at 950° makes the material about twice as ductile as it was in the original rail, but the tenacity is considerably reduced. The heating to the rolling temperature causes an enormous development in the size of the crystals, but these are broken up and become about one-eighth of the dimensions by heating to 950° C. and slowly cooling afterwards, and the structure so obtained is twice as fine as it was in the normal rail.

Some further experiments on the diffusion of sulphides through steel were described by Prof. E. D. Campbell, of the University of Michigan. They appear to sustain the conclusions drawn from his work—that iron is permeable by sulphides when heated above 1200° C., and that the sulphur content of the iron is not necessarily increased by the passage of the sulphide through it. In fact, in a slightly oxidising atmosphere the sulphur content of the steel may be even less after the diffusion than it was before. The author is not prepared at present, from the experimental data at hand, to give a positive explanation of the manner in which sulphides permeate or diffuse through iron. The most plausible hypothesis would seem to be that the sulphides originally present in the iron fill more or less completely the interstitial spaces between the crystals of iron; that above 1200° these sulphides are very fluid, and may be drawn out of the steel by capillary action of some absorbent such as asbestos, and their place taken by some other sulphides, provided these latter are sufficiently mobile to find their way into the extremely minute spaces between the steel crystals. If the sulphide replacing the original sulphide contain less sulphur than the latter, or if absorption by the asbestos continued after the sulphides had ceased to enter the iron from within, the diminished percentage of sulphur in the steel at the hot end would be readily accounted for.

The paper by Prof. A. Stansfield on the overheating and burning of steel was a report on work carried out by him